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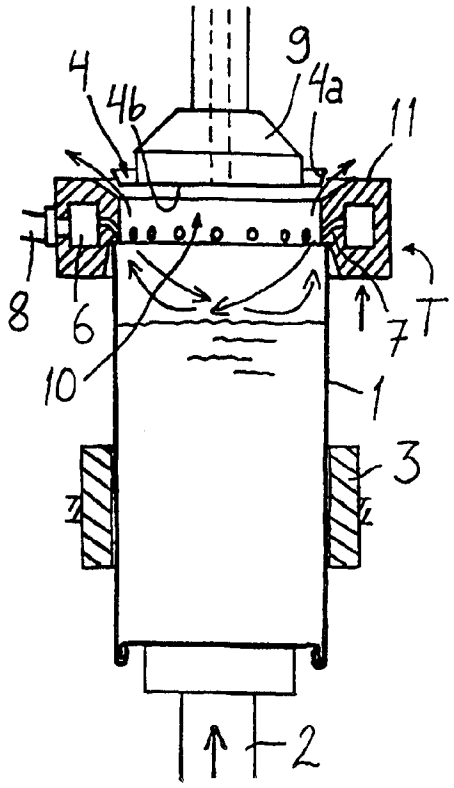
(57) Abstract

The apparatus for changing the gas composition inside a packaging container, especially for transferring protective gas or the like into a sealable container, comprises a passage for transferring a gas composition into a filled container. Said apparatus comprises a filling plane (T), which is provided with a centre opening (10), and a feeding device in order to position the filled container (1) under the centre opening (10), whereby the passage (8) for transferring the gas composition is brought to the filling plane (T) for transferring the gas composition into the container (1). Moreover, the apparatus comprises a feeding device for positioning the lid (4) above the filling plane (T), and transfer devices for moving the lid (4), the filling plane (T) and the container (1) closer to each other in the direction of a vertical line passing through the centre opening (10).



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Apparatus for changing the gas composition inside a packaging container

The present invention relates to an apparatus for changing the gas composition inside a packaging container. The invention relates particularly to an apparatus for transferring protective gas or the like into a sealable container, the protective gas or the like being fed into the container on top of the content, the container typically containing a foodstuff, such as juice or other liquid, before the container is sealed with a lid or with a closing flap. Apparatuses of this kind are used as a part of sterilisation and filling lines for liquid packaging containers, and they are located in their own stations, through which the unsealed liquid packaging containers are conveyed. A typical sterilisation and filling line has been presented for example in the publication EP-479010. The protective gas or the like may, for example, be nitrogen or another suitable gas composition. Examples of the techniques for feeding protective gas into a container have been presented in the publications WO 96/41743, EP 63235 and US-5071667.

Moreover, it is known in the prior art to feed inert gas and to fill the container filled in practice simultaneously while the container is stopped at the same station, as presented in the publications US-3212537 and US-4693054. The apparatuses for feeding both the gas and the filling liquid at the same processing station are of complex structure.

Thus it is known to feed protective gas or the like into a container by means of various nozzles or the like, particularly so that the gas is transferred into an at least partly open container, which is then fully sealed with a lid or a closing flap. During the feeding, the container and its closing structure are, consequently, at least partly separate, and the inert gas must be made to flow in a suitable manner on top of the content of the already filled container and to fill the free space effectively thus displacing the existing gas. Thereafter, the container must be rapidly closed. The nozzle or the like in the known solutions may, for example, be a member consisting of tubular or hose-like parts, which must be properly positioned with respect to the container and its lid or closing flap. Likewise, it is important to ensure that the lid or the closing flap leaves a suitable gap for the nozzle, and that the displaced gas is able to flow freely out of the container.

A further drawback of the known solutions is the fact that it is not possible to achieve high efficiency when feeding protective gas or the like into a container, as some of the protective gas or the like is unnecessarily released into the space surrounding the container, and small concentrations of the gas to be displaced, which usually contains oxygen, such as air, remains in the free space on top of the content of the container. It is therefore difficult with the known solutions to obtain with certainty the desired density of the protective gas or the like in the container.

The purpose of the present invention is to present an apparatus for transferring protective gas or the like into a sealable container above the content, with which apparatus the drawbacks of the known solutions can be to a great extent be overcome, thus improving the state of the art. To fulfil this purpose the present invention is characterised by what is presented in the characterising part 1 of the attached claims. The filling plane, to which the protective gas passage or the like is brought, is provided with a centre opening so that the protective gas or the like can be fed via nozzle ducts in the filling plane into the container below, while the lid is apart from the container and ready substantially above the filling plane. The upper edge of the container can then be brought inside the centre opening of the filling plane, in order to ensure leak-proof filling.

An apparatus according to the present invention enables the feeding of protective gas or the like into a container to be performed in such a way that there will be no free air space between the container and the lid into which protective gas or the like could unnecessarily be released. This means that the density of the protective gas or the like in the container can be optimised by means of the said apparatus, and the desired advantageous flow pattern, which flushes the free space above the content of the container, can be attained by the distribution and direction of the nozzle ducts which open onto the inner surface of the centre opening above the upper edge of the container. Obviously, the quantity of protective gas or the like needed will decrease, since no gas is unnecessarily released into the space surrounding the container, in other words, the flow rate does not need to be oversized in order to achieve the desired efficiency.

Other characterising features of the apparatus according to the present invention are presented in the attached dependent claims.

The invention is described in greater detail in the following, with reference to the accompanying drawings, in which

figure 1 illustrates the equipment according to the present invention and the initial situation of the filling stage,
figure 2 illustrates the second phase of the filling stage,
figure 3 illustrates the final situation of the filling stage, and
figure 4 illustrates the situation in which the container is essentially sealed.

The apparatus, in outline, consists of a pusher 2, above which the containers 1 are brought in succession by means of a conveyor 3, of a filling plane T, which is above the conveyor 3, and of an upper retainer 9, which supports a lid 4.

The filling plane T is essentially a planar profiled member as to its general shape, its greatest dimension being in the horizontal plane. An essential part of the filling plane T is the annular passage 6 inside it, into which is introduced a passage 8 from an outside protective gas source, and inside which the protective gas or the like has been arranged to move. At least one, but preferably more nozzle ducts 7 have been introduced radially inwards from the annular passage 6 through the centre opening 10, which passes through the walls of the filling plane T, whereby the nozzle ducts 7 are appropriately distributed on the inner perimeter limiting the centre opening 10. The protective gas or the like can be introduced into the annular passage 6 via the passage 8, and out of the annular passage 6 into the centre opening 10 and into the container 1 via the nozzle ducts 7. The cross-section of the centre opening 10 corresponds to the cross-section of the container to be filled, and it is advantageous that the annular passage 6 fully encircles the centre opening 10. Obviously, the annular passage 6 can also consist of several parts.

The protective gas or the like can be introduced from a separate gas container or the like, in which case the passage 8 can be a hose or a tube. The feed system for the

protective gas or the like includes control devices, known as such, for synchronising the feeding of the gas with the pace at which the container are processed.

In order to transfer protective gas or the like into a container 1, the container1 is positioned by means of the conveyor 3 underneath the stationary filling plane T. Feeding into the station is performed by means of a stepwise advancing conveyor, known as such, but still advantageously so that the upright container 1 is supported from the side by a ring support or the like incorporated in the conveyor 3, and its downward movement is prevented, for example, by horizontal supports positioned underneath it, such as slide rails on which the container can slide. Considering the functioning of the apparatus, the container 1, which can contain foodstuff, usually liquid, such as juice, is preferably round in its horizontal section, but it is obvious that other forms are also possible. The container may, in other words, also be another closed shape in horizontal section, for example, a square. The most suitable material for the container and lid is liquid packaging board.

Figure 1 illustrates the initial situation, after which the filling plane and the container are brought closer to each other in the direction of a vertical line passing through the centre opening 10. In a constant position on the track of the conveyor 3, the pusher 2 is arranged in such a way that it can move back and forth in an upright position between the structures supporting the container from underneath. By means of the pusher 2, the container is lifted from the bottom towards the filling plane T. When the upper edge of the container 1 meets the filling plane T, it impacts the shoulder 5 or the like formed in the inside wall of the centre opening 10, which shoulder has been arranged to stop the movement of the container 1 in relation to the filling plane T (figure 2). The shape of the centre opening 10 corresponds closely to the cross-section of the container 1, and in particular the upper part of the centre opening 10a, from the shoulder 5 up, is the size of the inner diameter of the container 1 or the like. Below the shoulder, the opening can continue as a downwards-widening guiding cone 10b. The shoulder 5 can be a solid member encircling the centre opening 10, but it can also be formed of one or several separate projections. However, with a solid shoulder surface a reliable tightness can be achieved during the feeding of the protective gas or the like.

After the container 1 has impacted the shoulder 5 or the like, the lifting of the container is continued, whereby the filling plane T also rises towards the lid positioned on the retainer 9. For this purpose, the filling plane T has been arranged to move freely on a vertical guide track. At latest when the container has settled on the shoulder 5 of the filling plane T, the feeding of protective gas or the like into the container 1 via the nozzle ducts 7 can begin. The nozzle ducts 7 are positioned so that their openings open into the centre opening 10a above the shoulder 5 and are directed more or less diagonally downwards, in order to produce a gas flow that reaches the top surface of the contents of the container as well as the corner between the top surface and the side wall, as illustrated by the arrows in the figure 2, which gas flow at the same time displaces the previous gas content from the top of the container. Further lifting with the pusher causes the superfluous gas which the container cannot hold to be released via the annular gap limited by the top surface of the filling plane T and the bottom surface 4b of the lid 4, which in figure 3 is formed between the bevel 11 of the top surface on the centre opening 10 side and the bottom surface of the lid's edge part 4a. The feeding of gas is stopped at latest when the lid reaches the level of the nozzle ducts 7.

The lid 4 has been arranged to be above the filling plane T in a position facing the centre opening 10 of the filling plane T, and consequently the opening of the container 1. The lid 4 has been fixed to the bottom surface of the retainer 9, for example, by means of a suction pad attachment, in such a way that it will later be released readily enough from the retainer 9. The retainer is firmly supported by a separate structure (not illustrated) and it is arranged to bring the lids 4 each in turn above the filling plane. It is obvious that another kind of arrangement for holding and releasing the lid 4 can be formed in the retainer 9.

The bottom surface of the retainer 9 is dimensioned in such a way that the part of the lid which is later to go inside the container 1 is substantially wholly against the retainer 9, and the edge part 4a of the lid 4, which has been folded upwards during manufacture, remains outside the bottom surface of the retainer 9. In order to position the lid 4 inside the container 1, the lifting movement is continued further until the lid 4 has passed via the centre opening 10 and been pushed into position inside the container 1, after which the upwards folded edge part 4a of the lid is against the inner wall of the container 1

(figure 4). The inner wall of the centre opening can then, at the same time, guide the edge part 4a of the lid into a more vertical position in line with the side walls of the container 1. As can be seen in the figures, an advantageous lid solution according to the invention is the kind in which the lid's edge part 4 has already been folded upwards beforehand for pressing the lid 4 into the container.

It is obvious that the positioning of the lid 4 in the container 1 can also be arranged so that the lid 4 is lowered, particularly at the end of the filling stage. In this case the retainer 9 is formed so as to move up and down by connecting it to a lifting device of some kind.

The movement of the lid and the container towards each other is slow enough to allow the protective gas or the like to push the other gas out, and the space between the content and the lid being full of protective gas or the like, some of it has time to flow out from outside of the edges of the lid before the lid is introduced inside the container. When the lid is pressed onto the container, the free volume above the contents decreases. A small overpressure can thus be created on top of the contents, which pressure helps to avoid underpressure forming and causing the container material to dent later, when the temperature decreases in the cooled storage premises of the delivery chain and the retailer. A small overpressure is also advantageous as regards antiseptic properties. The pressure, however, should not be so great that it pushes the still unsealed lid 4 off the container.

From the situation in figure 4, the pusher 2 is lowered, which enables the filling plane T to be lowered into the down position, and the container 1 is lowered further so that it can be moved forward by means of the conveyor 3 to the processing stage where the lid 4 is heat sealed onto the container 1 by heating up the heat-sealable plastic material on the bottom surface of the lid and on the inner surface of the container, and by folding the upper edge of the container 1, which is left on top of the edge part 4 of the lid, over the edge part 4a. The pusher 2 can be arranged to have a gripping arrangement, for example, mechanical or by suction, for gripping the container 1, in case this is necessary to pull the container 1 with the lid 4 quickly down and/or to ensure that it is lowered.

Alternatively, or as well as the pusher 2, the solid support structures can also be provided with suction to ensure that the container moves downwards.

The lid 4 can have a closing flap, known as such, which is removed in order to open the aperture on the lid. It is also possible that the lid 4 functions as the bottom of the ready-to-use container 1, in which case the lid with the closing flap, which in the situation of use comes on top, is on the bottom side in the situation shown in figures 1-4.

Power source and control device solutions, known as such, are applied in order to perform the pusher 2 and the nozzle opening functions.

The invention is not limited to the embodiments described and illustrated in the figures above, and thus they can differ within the scope of the invention presented in the adjoining claims. The lid 4 can be pressed onto the container by lifting the container, by lowering the lid with the retainer, or, in principle, by both movements simultaneously. In the same way, in principle, it is possible to hold the container 1 at the same height and to lower the filling plane T and the lid 4 in order to perform the said functions. Using the pusher 2, however, has the advantage that the three parts can be moved closer to each other with only one actuating device.

The movement of the container 1, the filling plane T and the lid 4 closer to each other is advantageously continuous, whereby the lifting motion performed by the pusher 2 is continuous, and the starting and finishing of the blowing of the protective gas or the like can be timed in a suitable way as regards the movement. It is possible, however, to stop the movement in certain positions for short periods of time.

The invention can be applied to all processes in which the gas composition is changed in the containers passing through the processing stage, regardless of the type of the gases. The gas composition to be changed above the content of the container is commonly an inert protective gas which does not react with the content, such as nitrogen or carbon dioxide, and the gas which is to be displaced typically contains oxygen from the surrounding air. It is, however, also possible to feed into a container a

gas composition in which the components react in a desired way with the content when they are left inside the container.

Claims:

1. An apparatus for changing the gas composition inside a packaging container, especially for transferring protective gas or the like into a sealable container, in which case the apparatus has a passage for transferring the gas composition into a filled container, **characterised** in that the apparatus comprises a filling plane (T), which is provided with a centre opening (10), and a feeding device in order to position the filled container (1) underneath the centre opening (10), whereby the passage (8) for transferring the gas composition is brought to the filling plane (T) for transferring the gas composition into the container (1), a feeding device for positioning the lid (4) above the filling plane (T), and transfer devices for moving the lid (4), the filling plane (T) and the package (1) closer to each other in the direction of the vertical line passing through the centre opening (10).

2. An apparatus according to claim 1, **characterised** in that the filling plane (T) comprises an annular passage (6) located inside it, and at least one, but preferably more nozzle ducts (7) connected to the annular passage (6), whereby the passage (8) for transmitting the gas composition is introduced into the annular passage (6) in order to transfer the gas composition into the container (1) through the nozzle duct(s) (7).

3. An apparatus according to claim 1 or 2, **characterised** in that the transfer device is arranged to move the upper edge of the container (1) underneath the filling plane (T), inside the centre opening (10).

4. An apparatus according to some of the previous claims, **characterised** in that the transfer device is a pusher (2) for lifting the container (1) into contact with the filling plane (T).

5. An apparatus according to claim 4, **characterised** in that the pusher (2) is arranged to lift the container (1) into contact with the filling plane (T) and the filling plane (T) into contact with the lid (4).

6. An apparatus according to some of the previous claims, **characterised** in that the transfer devices are arranged to transfer the lid (4) through the centre opening (10) of the filling plane (T) into contact with the container (1).

7. An apparatus according to some of the previous claims, **characterised** in that the surplus gas composition is arranged to flow out from the gap between the upper surface (11) of the filling plane (T) and the bottom surface (4b) of the lid (4).

8. An apparatus according to any of the previous claims 3-7, **characterised** in that the centre opening (10) is provided with a shoulder (5) or the like, which the upper edge of the container (1) is arranged to impact when the filling plane (T) and the container (1) are moved closer to each other.

9. An apparatus according to some of the previous claims 5-8, **characterised** in that the transfer devices are arranged so as to transfer the lid (4) essentially below the upper edge of the container (1).

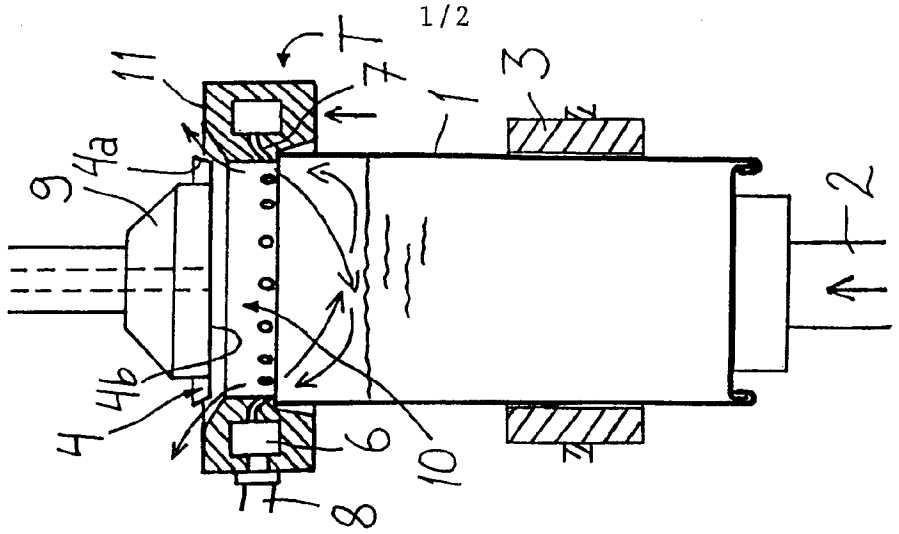

Fig. 3

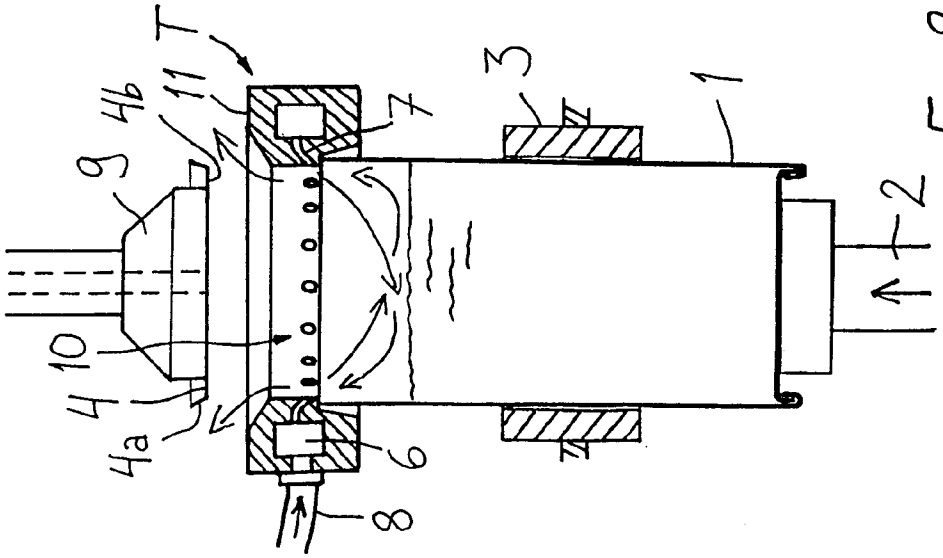

Fig. 2

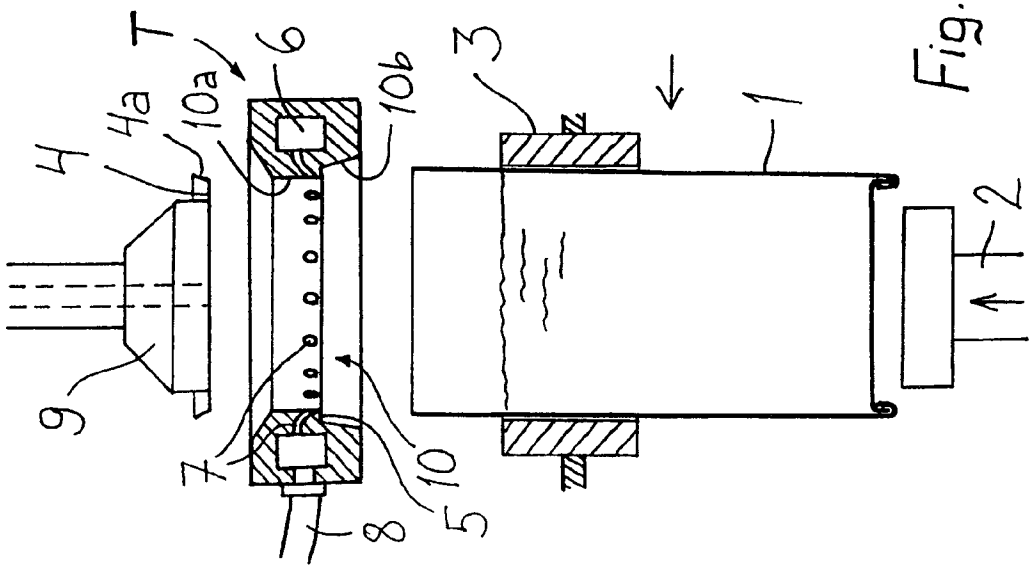

Fig. 1

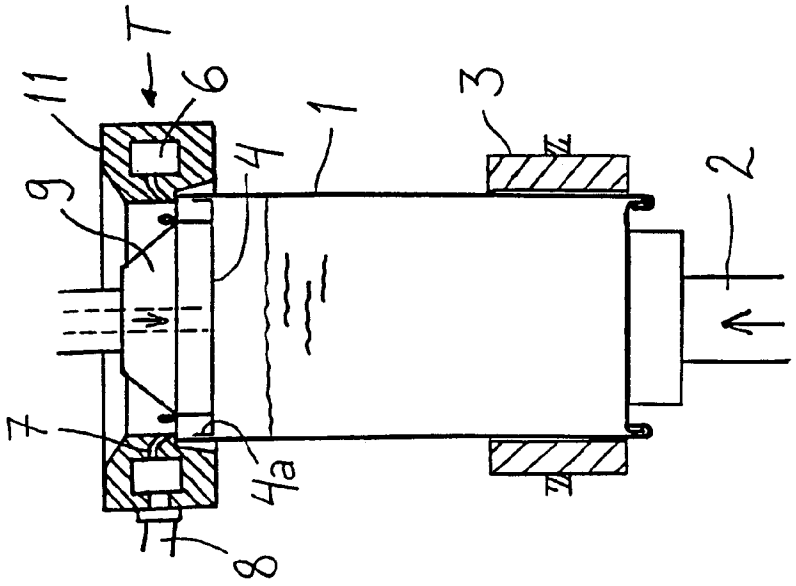

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65B 31/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4918902 A (HONMA ET AL), 24 April 1990 (24.04.90), column 1, line 42 - column 4, line 5, figures 1-4	1-9
X	EP 0214372 A1 (ROBERT BOSCH GMBH), 18 March 1987 (18.03.87), figure 1, abstract	1,2
X	EP 0692426 A1 (ALCOA DEUTSCHLAND GMBH), 17 January 1996 (17.01.96), figures 1-3,5, abstract	1,2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Information on patent family members

30/08/99

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4918902 A	24/04/90	EP 0352382 A,B	31/01/90
		JP 63191723 A	09/08/88
EP 0214372 A1	18/03/87	DE 3524926 A	15/01/87
		JP 62016318 A	24/01/87
EP 0692426 A1	17/01/96	DE 4424098 A	18/01/96